FIG.1

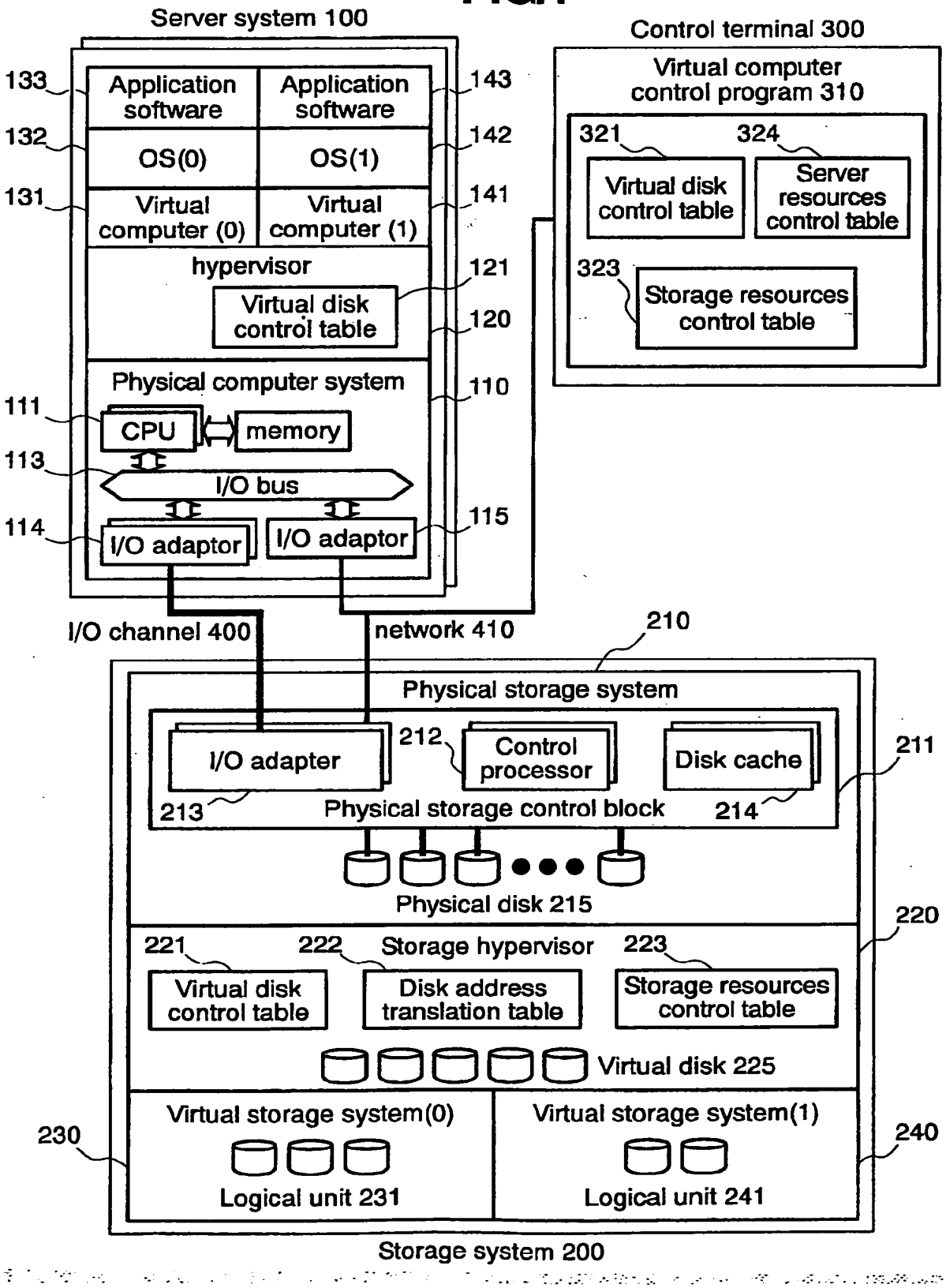

Server system 100
Control terminal 300
Virtual computer control program 310
133
Application software
Application software
143
132
OS(0)
OS(1)
142
131
Virtual computer (0)
Virtual computer (1)
141
hypervisor
121
Virtual disk control table
120
Physical computer system
110
111
CPU
memory
113
I/O bus
114
I/O adaptor
I/O adaptor
115
321
Virtual disk control table
324
Server resources control table
323
Storage resources control table
I/O channel 400
network 410
210
Physical storage system
I/O adapter
212
Control processor
Disk cache
211
213
Physical storage control block
214
Physical disk 215
220
221
Virtual disk control table
222
Storage hypervisor
Disk address translation table
223
Storage resources control table
Virtual disk 225
Virtual storage system(0)
Virtual storage system(1)
230
240
Logical unit 231
Logical unit 241
Storage system 200

FIG.2

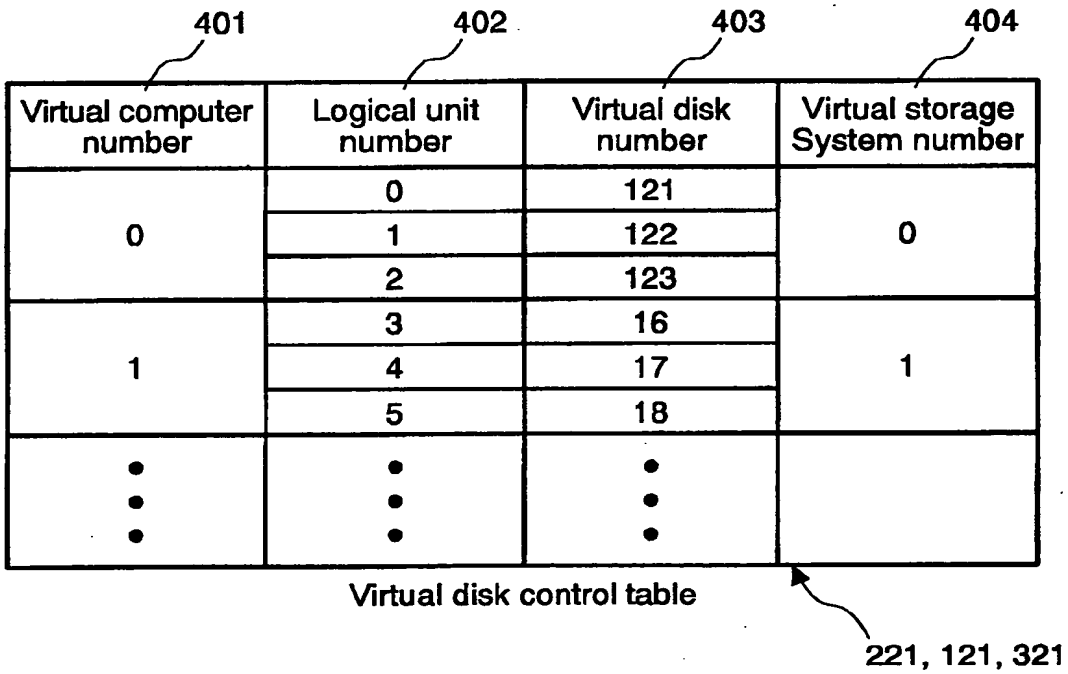

401
402
403
404
Virtual computer number
Logical unit number
Virtual disk number
Virtual storage System number
0
0
121
1
122
2
123
1
3
16
4
17
5
18
Virtual disk control table
221, 121, 321

FIG.3

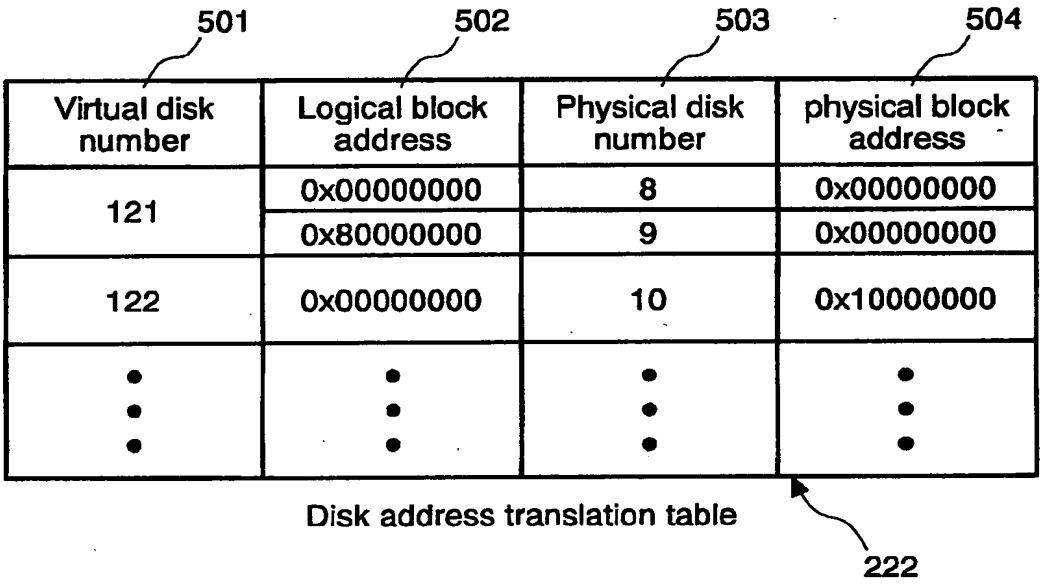
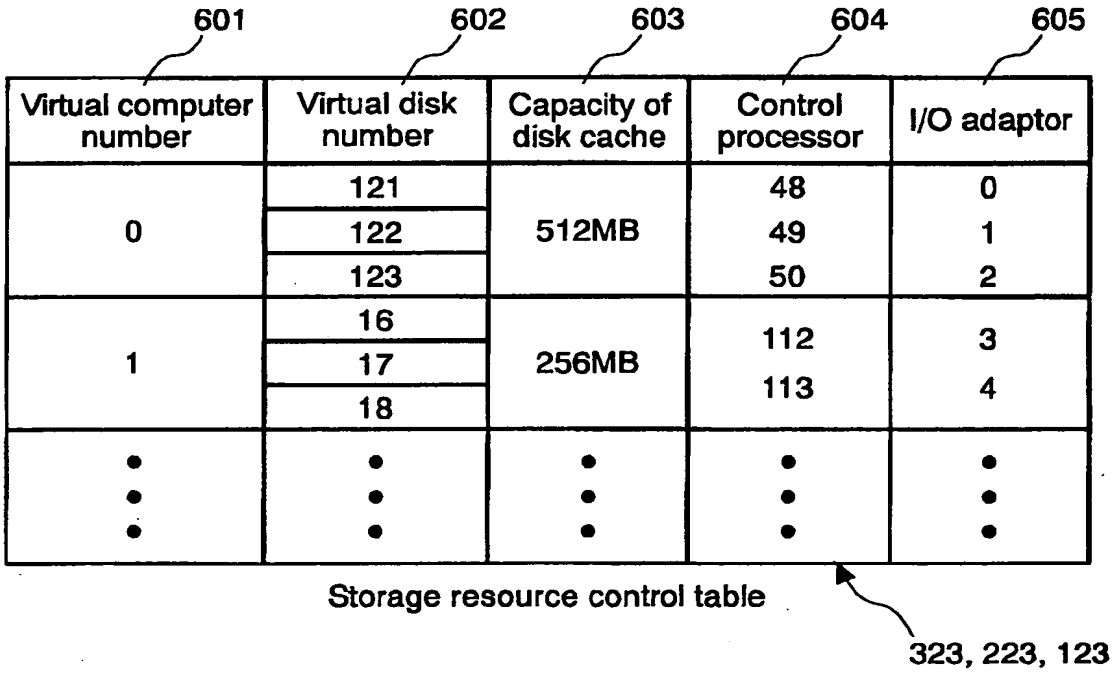

501
502
503
504
Virtual disk number
Logical block address
Physical disk number
physical block address
121
0x00000000
8
0x00000000
0x80000000
9
0x00000000
122
0x00000000
10
0x10000000
Disk address translation table
222

FIG.4



601 Virtual computer number	602 Virtual disk number	603 Capacity of disk cache	604 Control processor	605 I/O adaptor
0	121	512MB	48	0
	122		49	1
	123		50	2
1	16	256MB	112	3
	17		113	4
	18			
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•

Storage resource control table

323, 223, 123

FIG.5

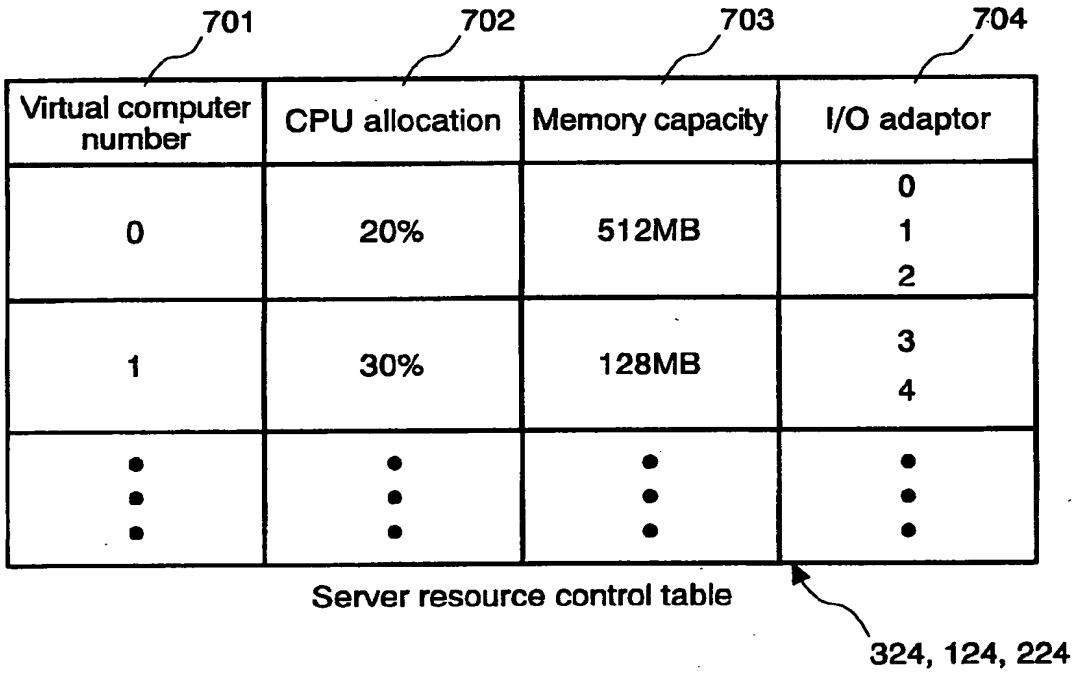

701
702
703
704
Virtual computer number
CPU allocation
Memory capacity
I/O adaptor
0
20%
512MB
0
1
2
1
30%
128MB
3
4
Server resource control table
324, 124, 224

FIG.6

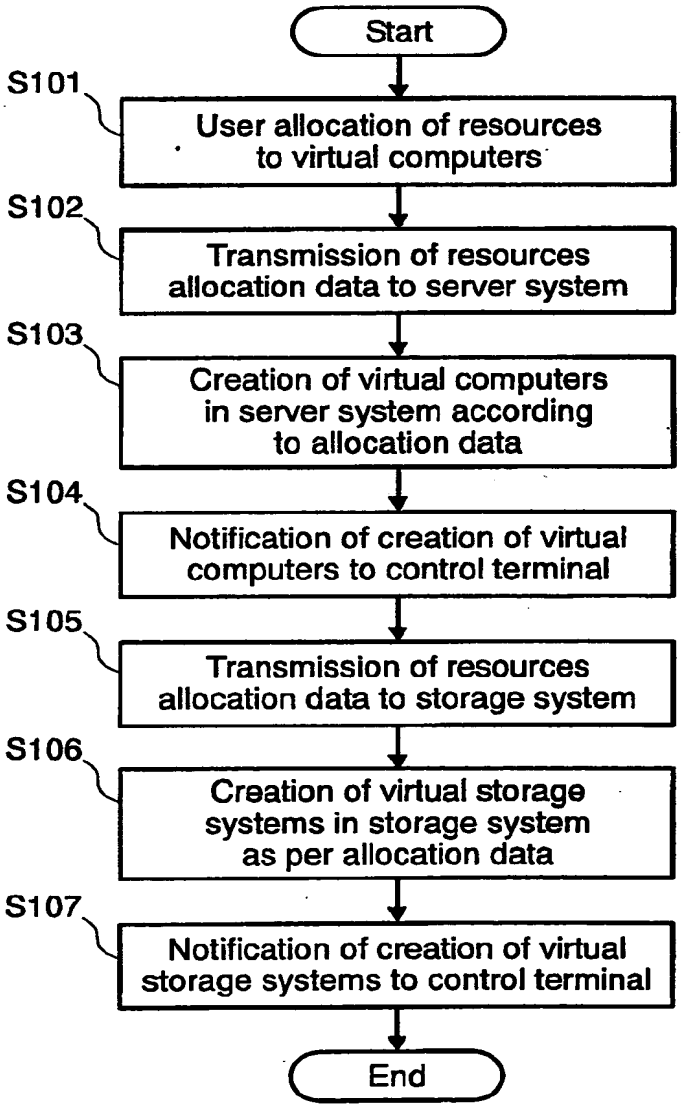

Start
S101
User allocation of resources to virtual computers
S102
Transmission of resources allocation data to server system
S103
Creation of virtual computers in server system according to allocation data
S104
Notification of creation of virtual computers to control terminal
S105
Transmission of resources allocation data to storage system
S106
Creation of virtual storage systems in storage system as per allocation data
S107
Notification of creation of virtual storage systems to control terminal
End

FIG.7

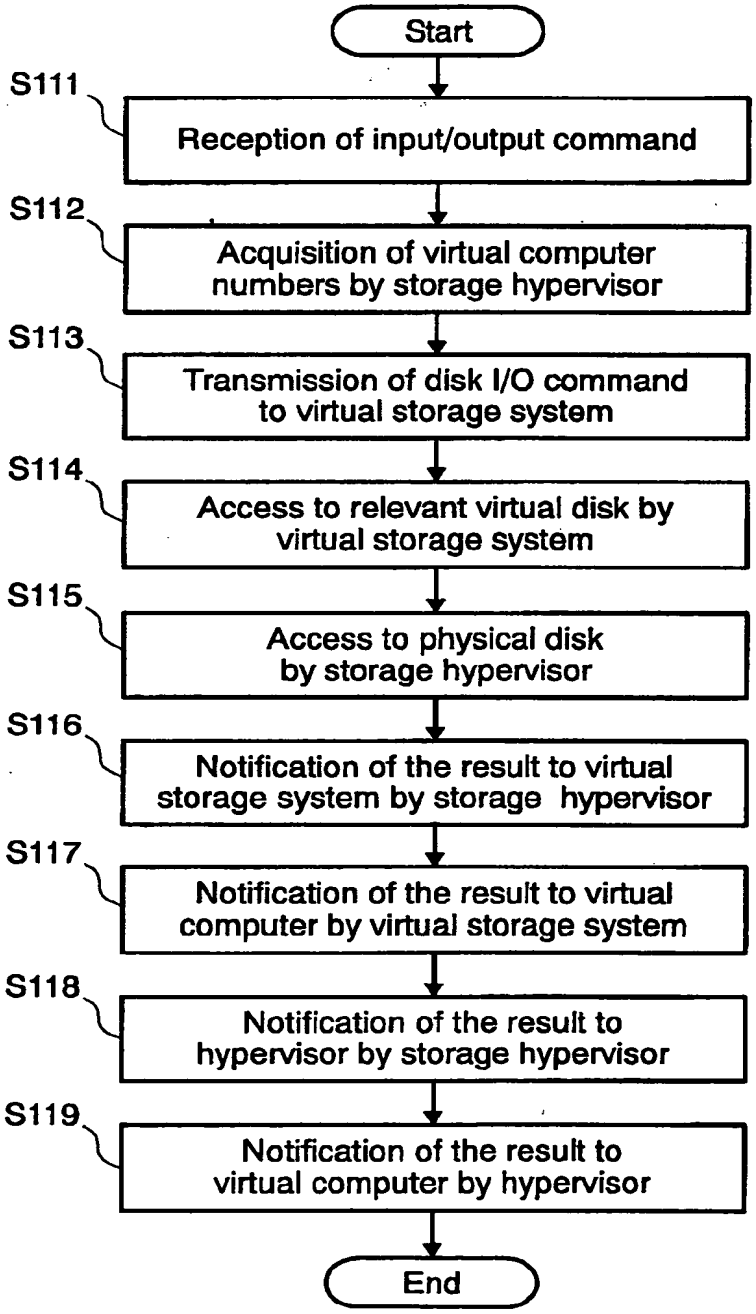

Start
S111
Reception of input/output command
S112
Acquisition of virtual computer numbers by storage hypervisor
S113
Transmission of disk I/O command to virtual storage system
S114
Access to relevant virtual disk by virtual storage system
S115
Access to physical disk by storage hypervisor
S116
Notification of the result to virtual storage system by storage hypervisor
S117
Notification of the result to virtual computer by virtual storage system
S118
Notification of the result to hypervisor by storage hypervisor
S119
Notification of the result to virtual computer by hypervisor
End

FIG.8

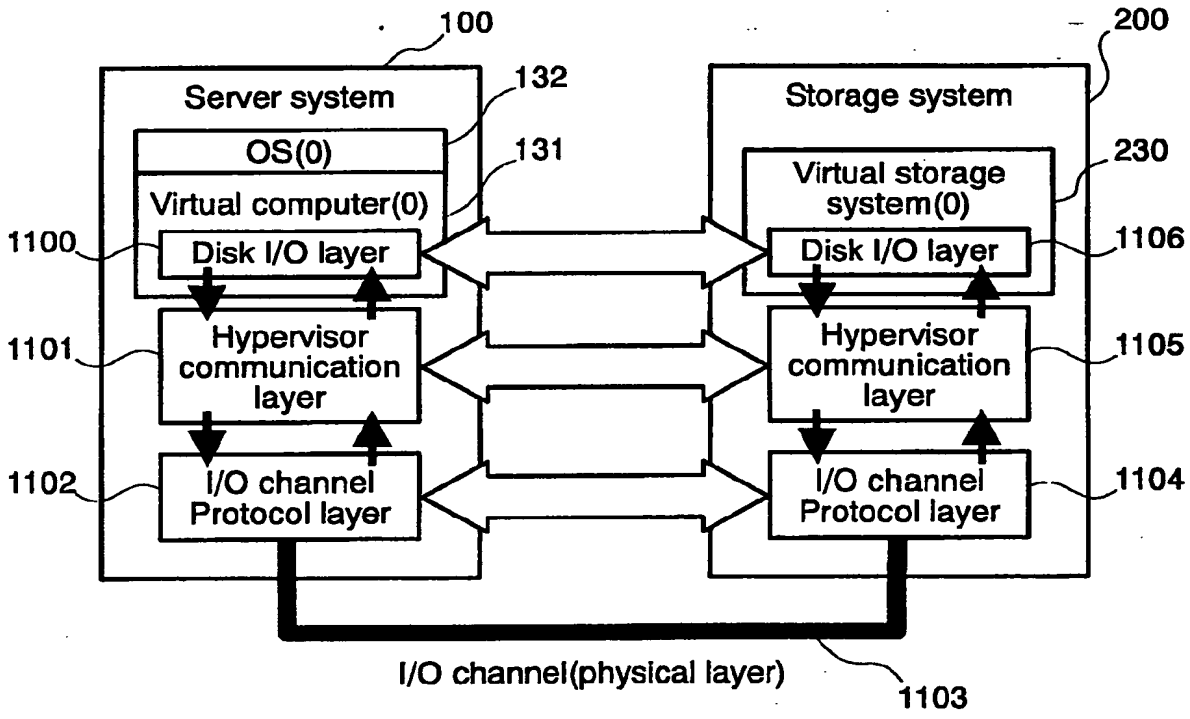

100
Server system
132
OS(0)
131
Virtual computer(0)
1100
Disk I/O layer
1101
Hypervisor communication layer
1102
I/O channel Protocol layer
200
Storage system
230
Virtual storage system(0)
1106
Disk I/O layer
1105
Hypervisor communication layer
1104
I/O channel Protocol layer
I/O channel(physical layer)
1103

FIG.9

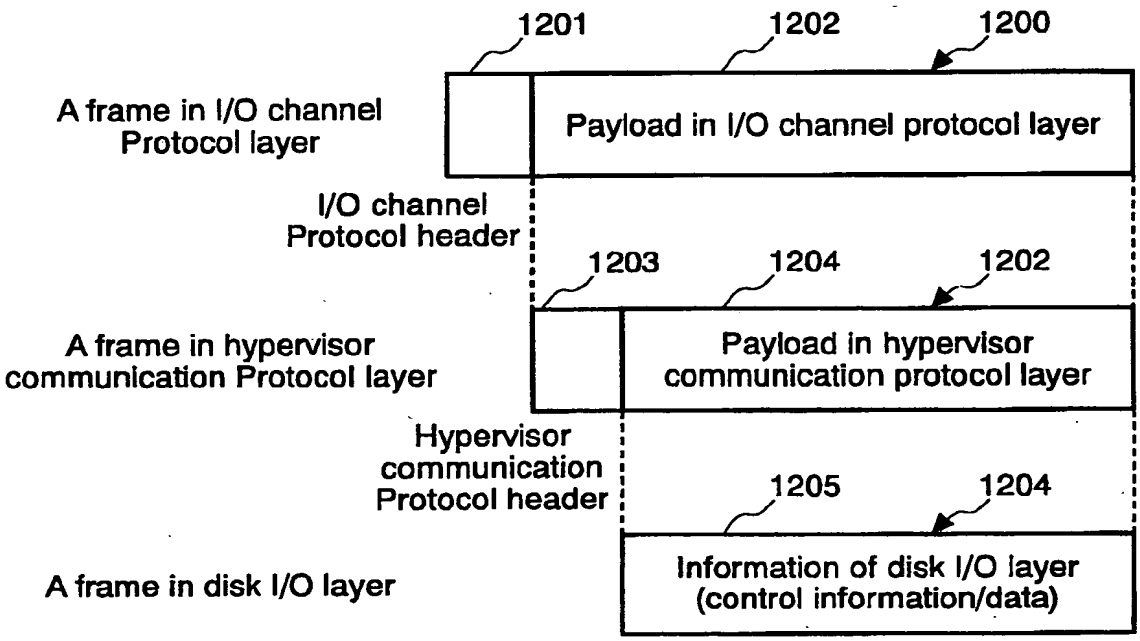

1201
1202
1200
A frame in I/O channel Protocol layer
Payload in I/O channel protocol layer
I/O channel Protocol header
1203
1204
1202
A frame in hypervisor communication Protocol layer
Payload in hypervisor communication protocol layer
Hypervisor communication Protocol header
1205
1204
A frame in disk I/O layer
Information of disk I/O layer (control information/data)

FIG.10

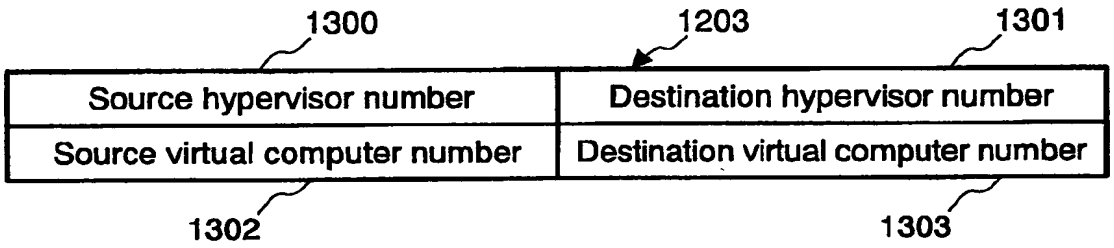

1300
1203
1301
Source hypervisor number
Destination hypervisor number
Source virtual computer number
Destination virtual computer number
1302
1303

FIG.11

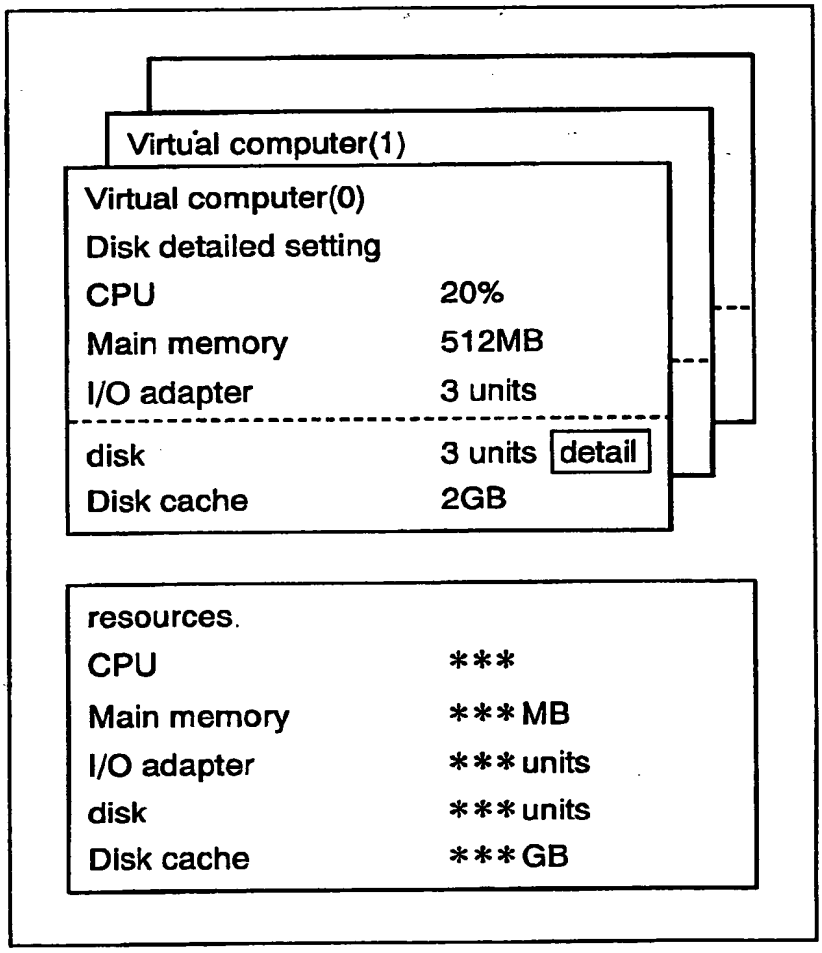

Virtual computer(1)
Virtual computer(0)
Disk detailed setting
CPU 20%
Main memory 512MB
I/O adapter 3 units
disk 3 units detail
Disk cache 2GB
resources.
CPU ***
Main memory ***MB
I/O adapter ***units
disk ***units
Disk cache ***GB

FIG.12

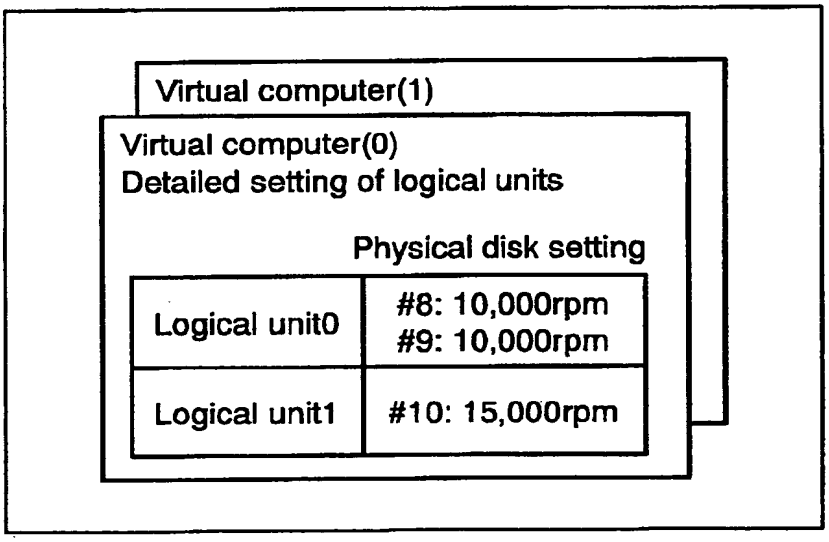

Virtual computer(1)
Virtual computer(0)
Detailed setting of logical units
Physical disk setting
Logical unit0
#8: 10,000rpm
#9: 10,000rpm
Logical unit1
#10: 15,000rpm

FIG.13

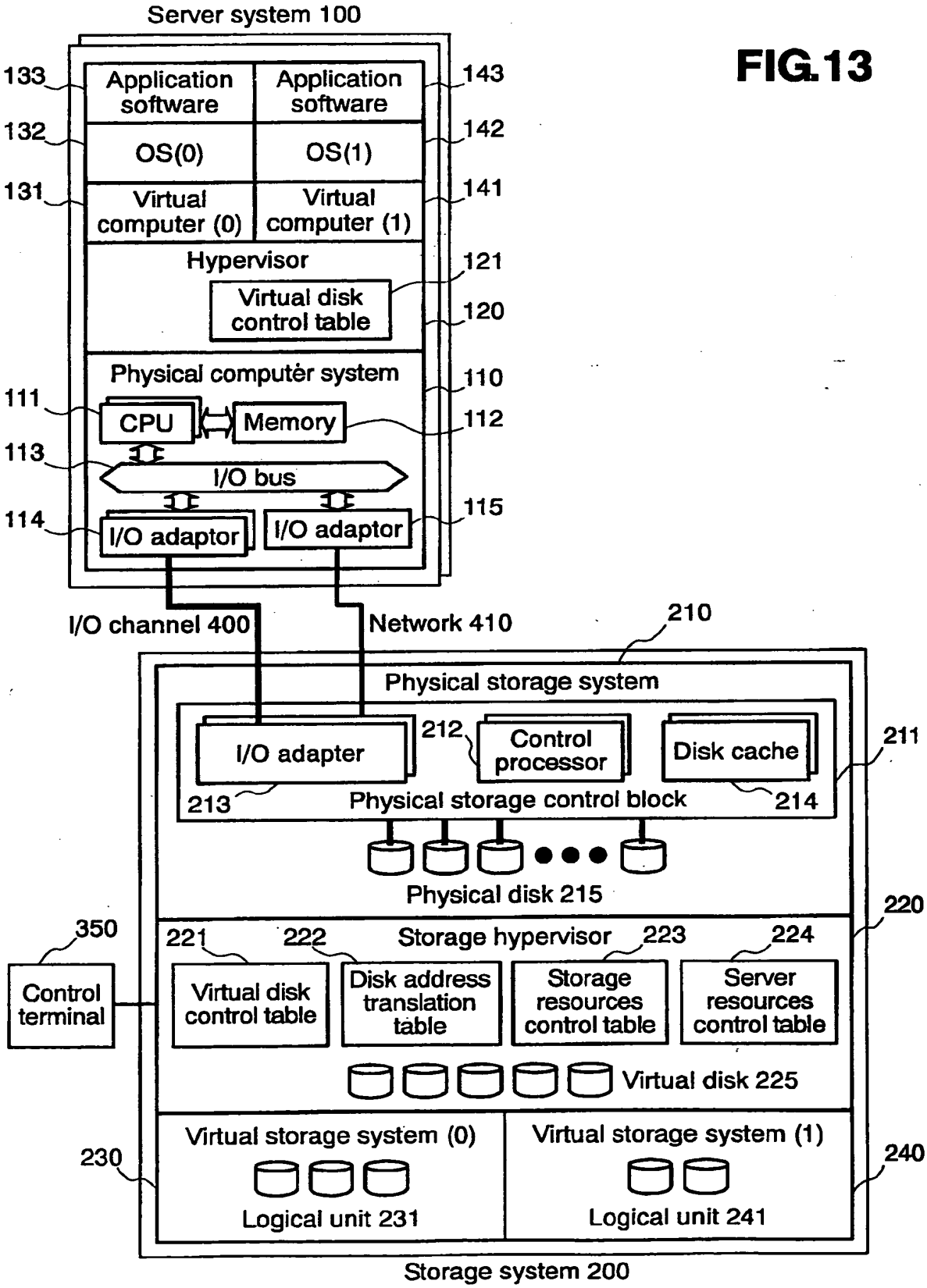

Server system 100
133
Application software
Application software
143
132
OS(0)
OS(1)
142
131
Virtual computer (0)
Virtual computer (1)
141
Hypervisor
121
Virtual disk control table
120
Physical computer system
110
111
CPU
Memory
112
113
I/O bus
114
I/O adaptor
I/O adaptor
115
I/O channel 400
Network 410
210
Physical storage system
I/O adapter
212
Control processor
Disk cache
211
213
Physical storage control block
214
Physical disk 215
220
350
221
222
Storage hypervisor
223
224
Control terminal
Virtual disk control table
Disk address translation table
Storage resources control table
Server resources control table
Virtual disk 225
Virtual storage system (0)
Virtual storage system (1)
230
240
Logical unit 231
Logical unit 241
Storage system 200

FIG.14

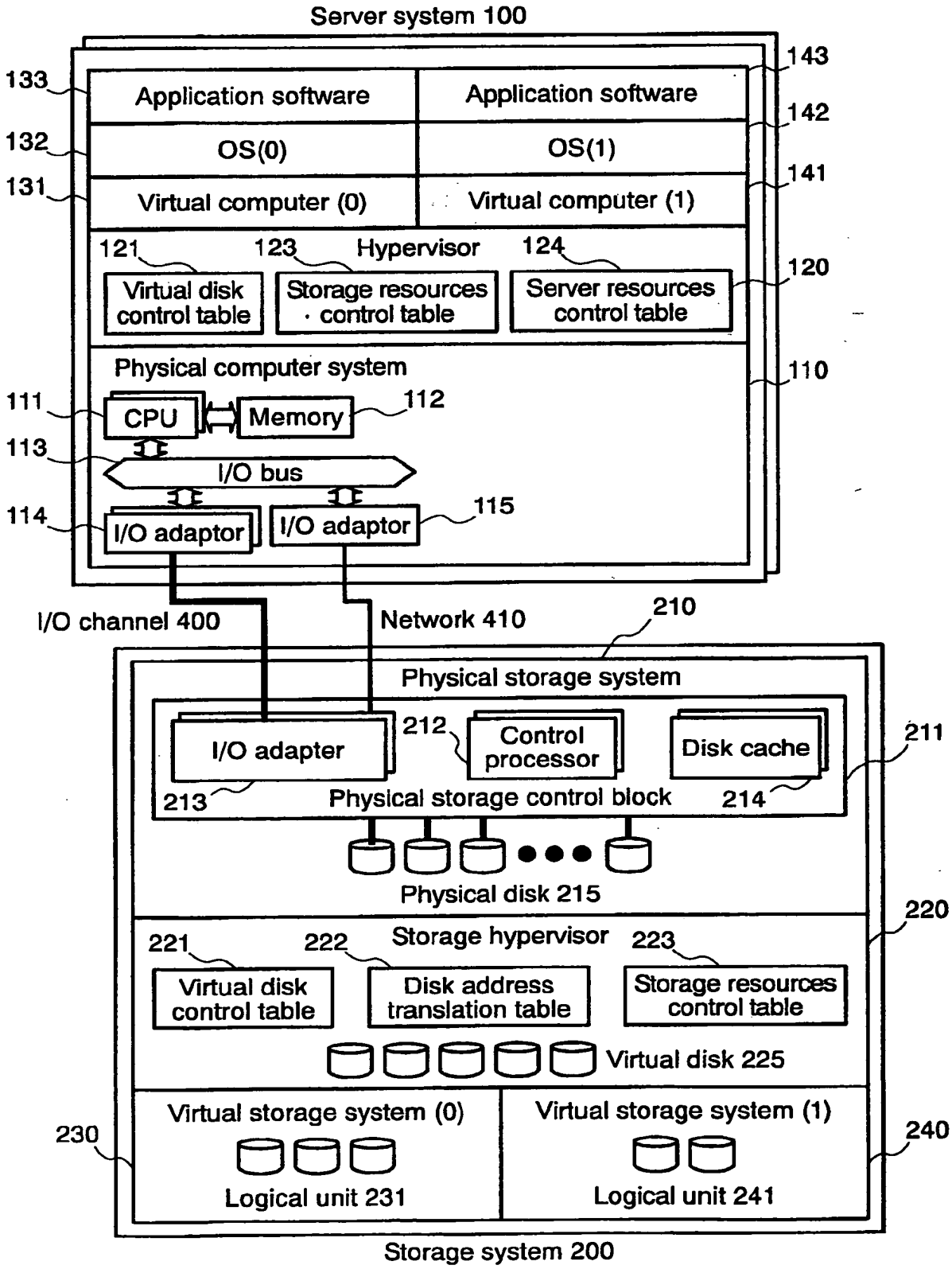

Server system 100
133
Application software
Application software
143
132
OS(0)
OS(1)
142
131
Virtual computer (0)
Virtual computer (1)
141
121
123
Hypervisor
124
Virtual disk control table
Storage resources · control table
Server resources control table
120
Physical computer system
110
111
CPU
Memory
112
113
I/O bus
114
I/O adaptor
I/O adaptor
115
I/O channel 400
Network 410
210
Physical storage system
I/O adapter
212
Control processor
Disk cache
211
213
Physical storage control block
214
Physical disk 215
220
221
Storage hypervisor
222
223
Virtual disk control table
Disk address translation table
Storage resources control table
Virtual disk 225
Virtual storage system (0)
Virtual storage system (1)
230
240
Logical unit 231
Logical unit 241
Storage system 200

FIG.15

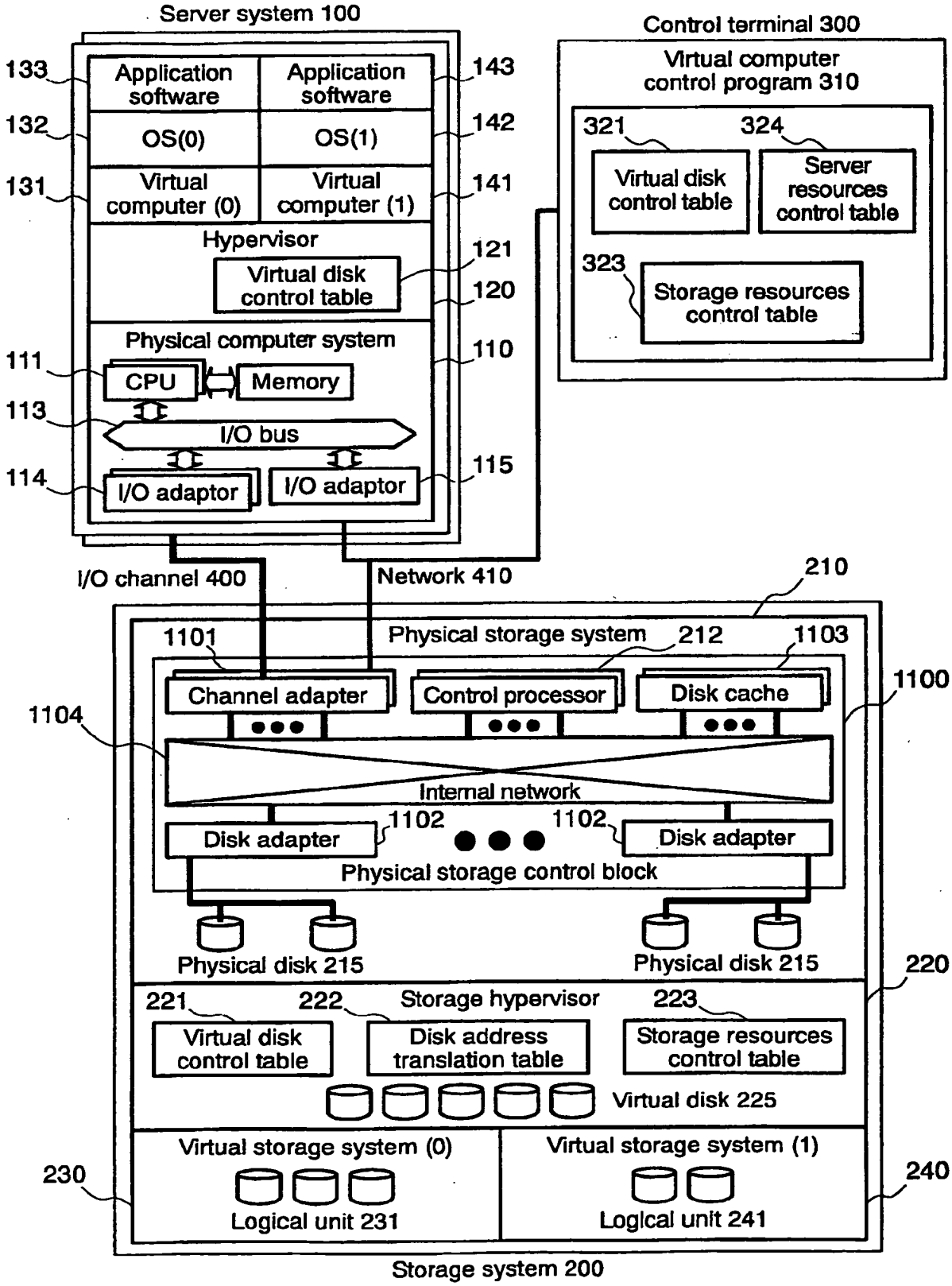

Server system 100
Application software
Application software
OS(0)
OS(1)
Virtual computer (0)
Virtual computer (1)
Hypervisor
Virtual disk control table
Physical computer system
CPU
Memory
I/O bus
I/O adaptor
I/O adaptor
133
143
132
142
131
141
121
120
110
111
113
114
115
Control terminal 300
Virtual computer control program 310
321
324
Virtual disk control table
Server resources control table
323
Storage resources control table
I/O channel 400
Network 410
210
1101
Physical storage system
212
1103
Channel adapter
Control processor
Disk cache
1100
1104
Internal network
1102
1102
Disk adapter
Disk adapter
Physical storage control block
Physical disk 215
Physical disk 215
220
221
222
Storage hypervisor
223
Virtual disk control table
Disk address translation table
Storage resources control table
Virtual disk 225
Virtual storage system (0)
Virtual storage system (1)
230
240
Logical unit 231
Logical unit 241
Storage system 200

FIG.16

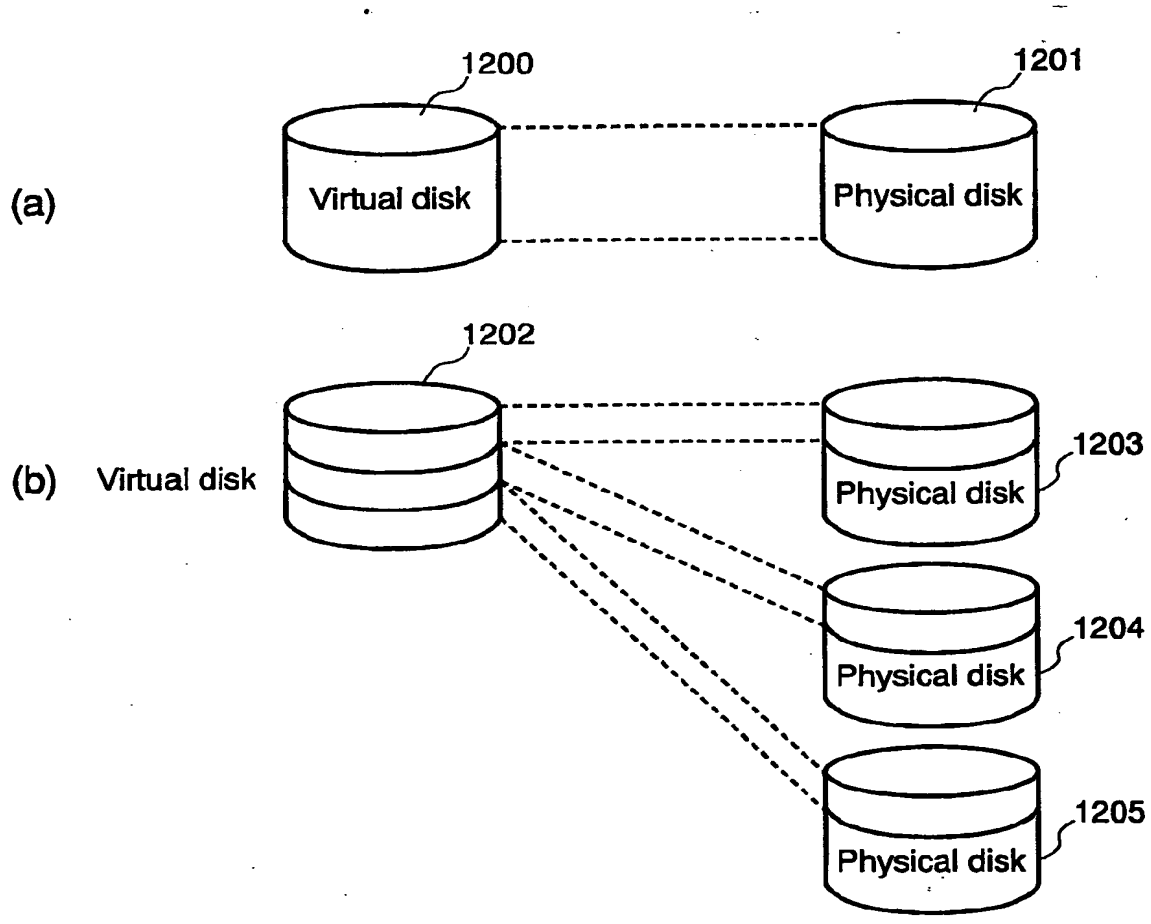

(a)
1200
Virtual disk
1201
Physical disk
(b)
Virtual disk
1202
1203
Physical disk
1204
Physical disk
1205
Physical disk

FIG.17

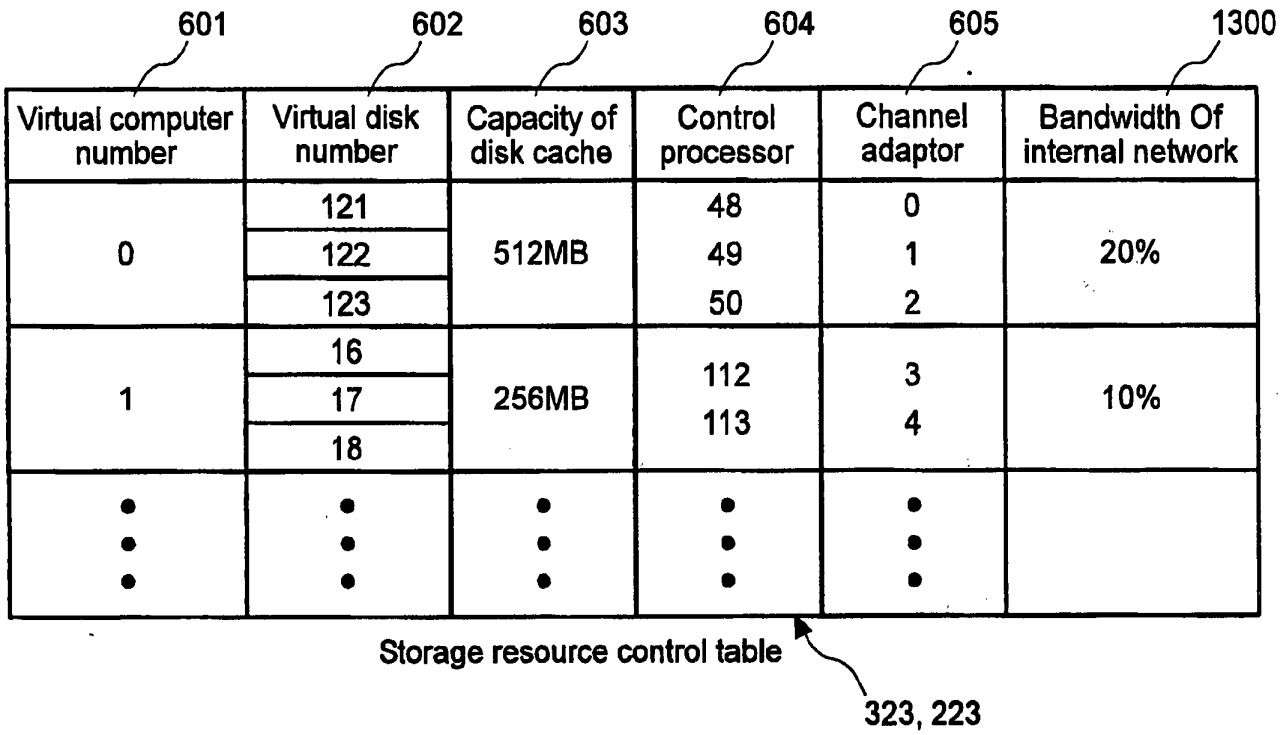
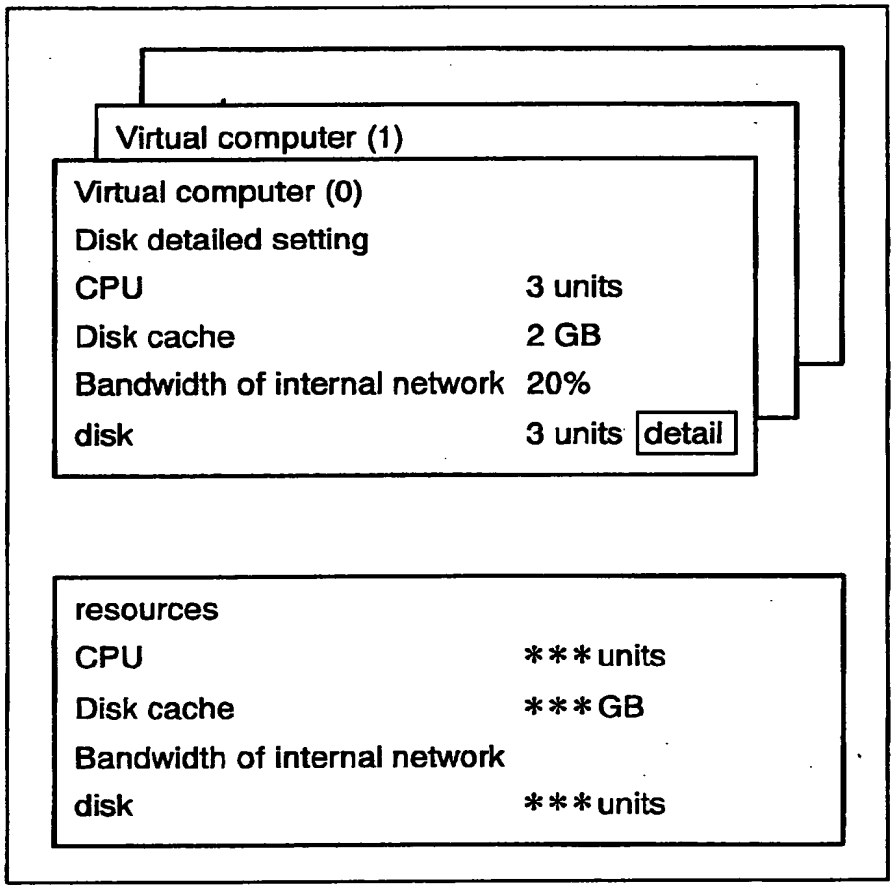

601
602
603
604
605
1300
Virtual computer number
Virtual disk number
Capacity of disk cache
Control processor
Channel adaptor
Bandwidth Of internal network
0
121
122
123
512MB
48
49
50
0
1
2
20%
1
16
17
18
256MB
112
113
3
4
10%
Storage resource control table
323, 223

FIG.18


Virtual computer (1)
Virtual computer (0)
Disk detailed setting
CPU 3 units
Disk cache 2 GB
Bandwidth of internal network 20%
disk 3 units detail
resources
CPU ***units
Disk cache ***GB
Bandwidth of internal network
disk ***units